Respirophasic Variation of IVC Diameter in Mechanically Ventilated Patients With Cardiovascular Disease

To the Editor:
The use of bedside ultrasound examination for the hemodynamic assessment of patients with cardiovascular instability is a promising technical development in various clinical settings. In a recent study, Iwamoto et al found a good correlation between the ultrasonographic measurement of the respiratory variation of the inferior vena cava diameter (IVCD) and central venous pressure (CVP) in spontaneously breathing children with heart disease, but could not find the same correlation in mechanically ventilated patients.1 Following these observations, it is worth pointing out our interest towards 2 basic concepts of the use of the IVCD and its derived variables.

1. As with any dynamic preload indicator under mechanical ventilation, the ventilation setting is of paramount importance for standardizing the results. In order to amplify cardiopulmonary interactions, regardless of the baseline ventilation setting, measurements of arterial waveform-derived variables tend to be taken with a positive end-expiratory pressure of ≤5 cmH2O and a tidal volume of 8–10 ml/kg.2 A similar protocol has been proposed in studies where the IVCD respiratory variation was examined as a preload index,3 whereas the ventilation parameters were not mentioned by Iwamoto et al.1 Furthermore, intrathoracic pressure variations during the respiratory cycle are strictly dependent on the compliance of the respiratory system: the higher the compliance, as in most pediatric patients, the higher the intrathoracic pressure and the hemodynamic effects of ventilation.4

2. In the aforementioned study,1 IVCD-derived variables were compared with CVP. While doing so, one should consider that, apart from the effects of mechanical ventilation, both cardiac filling pressures and IVCD are influenced in a different fashion by 2 main factors: (1) myocardial dysfunction and (2) volume status. Marik et al found that CVP may be taken as a good parameter of right ventricular function, whereas its routine use as preload indicator is questionable.5 In the light of this assumption, one may argue that in patients with myocardial dysfunction and a significant increase of cardiac filling pressures, the IVCD respiratory variation is reduced, alongside the CVP increase, because the IVC is closer to its maximum distention. Assuming that in these patients both CVP and IVCD distensibility change concurrently with a single variable (right ventricular function), it may be possible to have a good correlation between these parameters. Yet, in patients without heart failure, the same correlation may not be found. In this setting, volume status is the major determinant of CVP and IVCD-derived variables and studies have found that IVCD respiratory variation is a better dynamic preload indicator than CVP.5,6

These factors may make the interpretation of the IVC ultrasonography uncertain, preventing widespread use of this method, although its potentials in the hemodynamic assessment of patients emerged several decades ago.8

To conclude, the use of new noninvasive hemodynamic variables has the obvious advantage of substituting subjective assessment of the patient’s status by a clinician with objective measures. However, as in the case of IVCD variations, further research is needed to establish how their use in patients with heart disease translates into clinical practice.

References

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